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United Nations Industrial Development Organization

Workshop on the Establishment of a
Consultative Group on Solar Energy
Research and Applications (COSERA)

Vienna, Austria, 8-10 December 1986

REPORT*

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I. Introduction

1. The Workshop on the Establishment of a Consultative Group on Solar Energy Research and Applications (COSERA) was held on 8-10 December 1986 at UNIDO headquarters in Vienna, Austria.

2. The Workshop was attended by 11 experts on solar energy from developed and developing countries, and UNIDO Secretariat staff. The list of participants is attached as Annex I.

3. The Workshop's objective was to consider and present recommendations on the possible establishment of a Consultative Group on Solar Energy Research and Application. The COSERA would be a mechanism for mobilizing international co-operation directed towards enhancing the effectiveness of solar energy research in developing countries and the transfer of results into industrial production, commercialization and widespread use. The COSERA would draw upon the model of the Consultative Group on International Agricultural Research (CGIAR), particularly in relation to the mobilization of donor interest and support. The Workshop was intended to be a preliminary activity leading to wider consultations with donor agencies and developing country institutions.

II. Opening of the Workshop

4. The Deputy Director-General of UNIDO's Department for Industrial Promotion, Consultations and Technology, who opened the Workshop, stated that the inception of a solar energy industry in many developing countries had to be nurtured along with the strengthening of the countries' appropriate scientific and technological capabilities. This approach was also derived from UNIDO's watchwords since the late 1970s: "Industry for Energy and Energy for Industry".

5. He recalled the series of international conferences urging the establishment of a co-operative mechanism on solar energy and drew attention to the promotional and information activities UNIDO had been pursuing towards this end. Next to agriculture, UNIDO considered solar energy as the sector most deserving of promotion of international

co-operation in research. It is infinitely renewable, abundant, and widely available in both developed and developing countries. He outlined some of the circumstances making it opportune for the Consultative Group to be set up, citing the example of the success of CGIAR and noting that several potential donors have already indicated their interest in such a group for solar energy. He emphasized the crucial role the experts would have to play in the establishment and operation of the Group.

III. Election of Officers

6. The Workshop unanimously elected Mr. O.A. El-Kholy, Kuwait, as Chairman and Mr. I. Chambouleyron, Brazil, as Rapporteur.

IV. Background

7. Welcoming the initiative of the UNIDO Secretariat and the timeliness of its proposal, the Workshop noted that the establishment of the Consultative Group had to be considered from the broader perspective of the international economy, and from the perspective of the status of co-operation in the solar energy field itself. The participants commended the Secretariat for providing the basic background paper which provided an excellent starting point for the discussions of the Workshop (see list of UNIDO documents in Annex II) and supplemented the information given in the background paper with the latest developments in their specialities and in activities worldwide.

8. The Workshop noted that in April 1983, experts meeting at the International Forum on Technological Advances and Development in Tbilisi, USSR, preparatory to UNIDO's Fourth General Conference, had recommended the establishment of a Consultative Group for Solar Energy Research and Application. Solar energy had also received attention at the High-Level Expert Group Meeting in Oslo, Norway, on Energy and Industrialization. At this meeting proposals made on specific activities in solar energy that could be undertaken by UNIDO, included the evaluation of the potential for solar industrial processing heat in the developing countries, possibly leading to local manufacture and assembly

operations. It had also been proposed that UNIDO should promote research leading to the manufacture of solar photovoltaics.

9. Finally, at UNIDOs Fourth General Conference in August 1984, political impetus was given to the earlier recommendations by the adoption of a resolution calling on UNIDO to "promote co-operation between institutions engaged in research and development on new and renewable sources of energy". This recommendation followed the same spirit as that of the Nairobi Plan of Action adopted by the United Nations Conference on New and Renewable Sources of Energy in 1981.

10. A review of selected research institutes in developing countries carried out by UNIDO in 1982, and updated in 1985/1986, showed that out of a 115 institutes included in the review, 43 were involved in research on photovoltaics (solar cell and systems), 25 with solar thermal collectors, 15 with solar thermal systems, and 6 with selective coatings, 10 were doing research on materials, and the rest on photo-electrochemical conversion. 22 institutes indicated that they were also taking solar radiation measurements. Main application areas were solar drying (47), water heating (33), water treatment (26), cooling and refrigeration (24), solar cooking (16), and water pumping (13); 6 institutes were engaged in research on industrial process heating and 4 on solar energy for greenhouses. The research and development budgets ranged from US$10,000 to several millions. The great majority had budgets of US$100,000 to 200,000, with an average professional staff of 5. However, it is not at all evident that activities are being harmonized in such a way as to achieve maximum impact in the energy sector globally, particularly in developing countries.

11. The Workshop was of the opinion that several factors thus indicate that the stage has now been reached where a more decisive thrust towards co-operation is needed. Among the factors are the relatively stagnant trends in solar energy equipment production and shipments; the somewhat conflicting trends in regard to the quantum of research funds being channelled into the field of solar energy; the availability of a certain amount of experience in the utilization of solar energy equipment by the developing countries; the existence of a large number of institutions in developing countries carrying out research in the field of solar energy;

and not least, the widely expressed desire for international co-operation. This, together with the ongoing though limited, co-operation at the regional level calls for the establishment of a Consultative Group on Solar Energy Research and Application (COSERA) at the international level, with the aim of promoting a critical mass of international effort related to solar energy research and application, in particular for the benefit of the developing countries.

V. Issues identified in the discussions

12. In presenting their papers and discussing the various aspects of solar energy and the concept of a consultative group, the participants highlighted the following main issues:

(a) A recognition that solar energy is an important tool for development. Solar energy is already competitive for remote area applications, but the target must be to widen its market in the developing countries. With appropriate research and development, cost could be substantially reduced, thus opening up new opportunities in developing countries for its application. In addition, through the application of advanced technologies, solar energy devices could be made more efficient, reliable and simple to operate.

(b) Solar energy should not be viewed in isolation from other sources of energy. It has to be an integral part of the country's overall energy plans and development objectives. Consequently, its role in overall development planning has to be clearly defined. These two requirements make it necessary that solar energy for developing countries be programme-oriented rather than a collection of isolated projects. Such a programme would have to cover all aspects of activities in the field of solar energy, from research and the development of technology to socio-economic aspects, production, commercialization etc. To enable solar energy to be included in overall development planning, up-to-date and appropriate data would have to be made available. This would require both

monitoring and the establishment of information systems. It was also stressed that solar energy activities needed a national focal point or government agency responsible for its promotion and development.

(c) Solar energy in general, and especially in the developing countries, faces a number of major constraints. These constraints can be categorized as economic, technical, institutional and social.

Solar energy devices tend to have a high initial investment cost together with a small market in the developing countries. This is a vicious circle which must be broken to expand markets and reduce costs. Furthermore, with the current low oil prices at the present time, compared with a few years ago, this has a dampening effect on solar energy development. However, this situation which is dependent on political as well as economic factors may not be an appropriate signal for efforts in the developing countries on solar energy. Finally, the energy markets in developing countries in which solar is competing, tend to be regulated by governments, i.e. heavily subsidized. This makes it very difficult for a new source of energy to break into these markets without equal economic support.

Many solar energy devices on the market in some developing countries are poorly made and, therefore, have low levels of reliability. Should this pattern continue, solar energy will acquire a bad reputation among consumers that will be hard to change. In developing countries there sometimes is a lack of scientific leadership in solar energy research. Thus research and development in the field lacks clearly-defined and relevant priorities. There is also a marked shortage in many cases of trained specialists and technicians in the field of solar energy. These have a negative impact on research, demonstration and commercialization.

The development and application of new technologies, such as solar, is often handicapped in developing countries by the poor linkages among the different sectors of the economy and the government departments involved. Different public institutions often operate with little or no regard for the effect of their actions on other sectors of the economy. The introduction and development of solar energy technology will require institutional co-ordination among the many government departments concerned. These institutional constraints will have to be overcome, otherwise even when low cost, efficient and reliable solar energy systems are developed, their dissemination will be severely hindered in the developing countries.

Any new technology which has to be absorbed by the commercial and household sectors requires a widespread and extensive public education and promotion programme. A technology such as solar energy is too often seen as a black box and is not also related to the social conditions of the country. For solar energy to make a breakthrough it is essential that a public awareness programme be developed and implemented. This should be aimed at all levels of society from school children to policy makers.

(d) Considerable research and application on solar energy has been going on in both developed and developing countries. A certain amount of co-operation has been undertaken between developed and developing countries, but very little as yet between the developing countries themselves. There is still plenty of room for research, demonstration and commercialization, especially reflecting local conditions, priorities and capabilities in the developing countries. This research and development work must have as its basic goals cost reduction, reliability and simplicity of operation.

(e) An area where developing countries appear to lack adequate effort can be classified as research-related activities for solar energy, particularly techno-economic studies. These

research programmes have to be undertaken as important adjuncts to the technical research and development work on solar energy. From experience in other energy areas, multidisciplinary research groups comprising scientists, engineers, economists and sociologists may be the most appropriate for this solar energy research-related activity.

(f) The Group endorsed the proposal of UNIDO for the establishment of a Consultative Group on Solar Energy Research and Application. It noted that the concept of a consultative group on solar energy with programme-oriented proposals has also been welcomed by a number of donor countries and agencies and that UNIDO had received expressions of interest, both written and oral, from several donors. It was also felt that the CGIAR could serve as a model and its experience be a useful example for the operation of the COSERA.

13. The Workshop divided into two working groups to examine (a) the policy aspects of the Consultative Group, and (b) technical considerations, respectively.

VI. Conclusions and Recommendations

(a) Policy aspects

14. The Workshop envisages the Consultative Group on Solar Energy Research and Applications (COSERA) as an institutional group of scientific establishments, donor organizations and financing agencies. the institutions will be ones of recognized achievement with a standard of excellence in research and applications of solar energy, or interest in the promotion of the harnessing of solar energy to development needs in various parts of the world. The members representing these institutions will be distinguished personalities of recognized standing in the field. The COSERA, if it is to achieve the objectives envisaged by the Workshop and detailed hereunder, needs to have the prestige and credibility essential for playing this role.

15. The COSERA is thus seen as a high-level forum for identifying, through collective interaction of its members: (a) the priority needs in research and applications that would promote the widespread use of solar energy in the overall development effort in the variety of situations in different parts of the world[as well as (b) the donor sources for financing activities to meet such needs. It would thus act as a catalyst that would achieve optimum results from the multitude of efforts in many organizations and in different countries. In its first phase of operation, COSERA will achieve such results through:

- assisting in establishing and/or strengthening links and synergy between the various actors in the field (donor agencies, governments, industry, scientists, citizen groups etc.);

- contributing to the achievement of maximum effectiveness in the flow of funds to research establishments, whether governmental or in industry, and mobilizing more funds for the high priority and most promising activities in the field, as identified through its deliberations;

- promoting closer integration of the results of solar energy research, development and applications, in the overall energy plans of countries or regions and within the framework of their development planning for a better life; and

- strengthening national capabilities at all levels (decision makers, planners, scientists, technicians, industrialists, bankers, promoters, and the public) in harnessing solar energy effectively to specific national needs.

16. It is of particular importance at this stage that the COSERA be project-oriented, rather than restricted to conceptual formulations. It would thus consider proposals for research, development and applications for recommendation to funding agencies, as well as propose to interested parties projects it considers of high priority, and indicate its willingness to help them, as they wish, in fulfilling their specific

tasks in promoting what it considers as the most appropriate venues for harnessing solar energy to their specific needs and local conditions. This covers the whole range of activities from basic research to applied research, development work, engineering, production, active promotion and widespread utilization, as well as monitoring and evaluating progress in these activities.

18. As the COSERA establishes its standing and prestige with the various types of organizations, national, regional and international, through its operations along the advisory and support roles outlined above, it could move into other phases in which it could embark on other activities and operations, as deemed appropriate at the time. These could include:

- supporting training and manpower development in the field of solar energy research and applications at all levels;

- establishing and/or strengthening mechanisms for the exchange of experiences and information;

- supporting the authoring and publication of directories, guidebooks, and other publications providing information on commercially exploitable technology, criteria and parameters in satisfying national needs, effective promotion and marketing of solar energy applications; and

- setting up and/or strengthening existing centres of excellence, at regional and international levels, as deemed necessary and useful.

18. The COSERA is not an intergovernmental body, nor will it "dictate" what needs to be done. It should endeavour to harmonize to the extent possible the variety of ongoing efforts and support new worthwhile ones. It will have to function with a minimum of legal or bureaucratic constraints, relying mainly on its prestige and credibility in achieving its objectives, and in securing a minimum level of obligation on the part of participating organizations, particularly donor agencies, in the

provision of information and willingness to discuss the results of their various efforts and experiences. The COSERA will not preclude any bilateral co-operation, now or in the future, nor will it substitute efforts in countries or interfere with existing commercial flows. It could, on the other hand, contribute to the establishment of viable solar energy industries in developing countries, and open up potential markets to international trades as well as promote sharply-focussed research linked to industrial application and widespread appropriate applications.

19. In order that the concept of COSERA outlined above be operationalized, the Workshop recommends that the UNIDO Secretariat set up a task force to elaborate these general indicative guidelines, and explore in more depth the level of interest, the modes of co-operation and involvement of those bodies, within and without the UN system, identified as desirable and interested participants in the establishment of the COSERA. The Workshop further recommends that on the basis of the findings of the task force, UNIDO organize a meeting in which COSERA will be established. It is hoped that such a meeting be organized by UNIDO before the end of next year. In the meantime, UNIDO is urged to continue its activities in providing technical assistance and information, publishing directories and other activities in the field of solar energy development and application.

(b) Technical considerations

20. For the formation of any group such as COSERA, it is important at an early stage to identify clearly subject areas of R&D and suitable applications where effective international co-operation may be primarily utilized. Specific areas in this context would be considered under two broad headings, these being solar photovoltaic and solar thermal. Many of the aspects considered under testing, reliability and materials research are common to both technologies.

Areas of R&D

- Reliability should be established for systems and components under a wide range of climatic conditions. Use could be made initially of existing testing facilities in such countries as

the USA, Australia and those in the European Economic Community. These tests should address important issues such as module encapsulation, durability of interconnections, and materials degradation.

- Efficiency testing. This is seen as a vital area relevant to the reduction of total system cost. There is a requirement for testing under well-defined simulated radiation conditions, and for practical outdoor testing. It is anticipated, initially, that such tests could be arranged on a co-operative basis with well established laboratories in developed countries.

- Systems research. In an attempt to develop optimized systems, it is recommended that attention be focussed on both high efficiency - high cost systems, and on lower efficiency - low cost systems. Sufficient emphasis should be given to balance of system component design to ensure good matching.

- Although many programmes of research into materials and devices are being carried out by developed countries, the Workshop recommends that these should also be performed in the developing countries. The existence of such research groups could ultimately become the origin of or support for local industry.

Indicative Applications

(i) Photovoltaic systems. These should include the following:

- water pumping and treatment
- communications
- medical refrigeration
- village lighting
- rural educational radio and T.V.
- small-scale power for rural industries

21. These should all be examined with a view to gaining hands-on experience and aiding in the training of locally based technicians. It should be realized that in many remote regions such systems are already cost-effective and are sometimes the only logical solution to the provision of off-grid power. Even though the impact on overall energy economies may be small, such systems could substantially enhance the quality of life in rural communities.

(ii) Solar thermal. These should include the following:

- water systems, including desalination and treatment
- drying systems to reduce post-harvest losses
- cooking and food processing
- cooling and refrigeration
- solar water heating (for hospitals, medical applications, tourist hotels, laundries, and food processing plants)
- passive solar energy applications in housing

22. The Workshop emphasized that the widespread use of solar thermal technologies will enable developing countries to lessen their dependence on imported fossil fuels, improve their balance of trade situation substantially, as well as maintain the health of their environment.

23. One of the primary duties of the task force to be set up to consider the establishment of the COSERA would be to build up a tentative portfolio of R&D and application projects in developing countries suitable for promotion at the international and regional level. In this task it would be important to examine existing projects in various regions which may be appropriate for funding, and to evaluate the potential for projects in other regions where none are currently in existence.

24. Such a portfolio of R&D and application projects necessitates that, as mentioned in the Recommendations on Policy Aspects (p.9, para. 18), consideration be given in due course to the establishment or strengthening of existing centres of excellence in developing countries, suitably located to serve as specialized centres of international scope for research, development and formal training of professional and technical staff. It may be advantageous to invite specialists from developed countries to advise in the establishment and direction of new programmes. However, every effort should be made to utilize local or regional experts in this capacity wherever possible.

ANNEX I

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ANNEX II

LIST OF DOCUMENTS

Aide Mémoire

Issue Paper	Establishment of COSERA: Issue Paper prepared by the UNIDO Secretariat

Conference Room Papers:

CRP. 1	Provisional Agenda
CRP. 2	Provisional Programme of Work
CRP. 3	Provisional List of Participants
CRP. 4	Provisional List of Documents
CRP. 5	Directory of Solar Research Institutes in Developing Countries (Addendum 1986)
CRP. 6	Consultative Group on International Agricultural Research (CGIAR) - a brief review
CRP. 7	A review of economic and technological requirements of solar cells: status and research directions of polycrystalline thin film devices, by T.J. Coutts
CRP. 8	New concepts in the field of thermal conversion of solar energy, by V. Wittwer
CRP. 9	Solar Thermal Technologies, trends in research, development and commercialization, by Prof. W.S. Charters
CRP. 10	Research and Development of Solar Energy Technology in India, by Prof. T.K. Moulik
CRP. 11	Solar Energy in Latin America, by Prof. I. Chambouleyron
CRP. 12	Solar and renewable energy in Zimbabwe and SADCC, utilization and future development, by J.E. Stevens
CRP. 13	Working paper for the preparation of a Prefeasibility Study for an Islamic Programme
CRP. 14	Prefeasibility Study, Islamic Network on Renewable Energy Sources

Background documents

Solar cell materials and fabrication technologies, by K.W. Boer

Study on amorphous silicon solar cells, by A. Madan

Global trends in technology, policy and firm strategy in photovoltaics, by K. Hoffman

Solar powered Stirling engines and their potential uses in developing countries, by W.T. Beale

Directory of Solar Research Institutes in Developing Countries, prepared by the UNIDO Secretariat (UNIDO/IS.341/Rev.2)